



# The New Millennium Program: Validating Advanced Technologies for Future Space Missions

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# Topics

- Program Objective
- Program Focus
- NMP Flight Team Partners and IPDT Members
- Microelectronics IPDT
- NMP Missions
  - Mission objectives
  - Technologies validated
- Summary

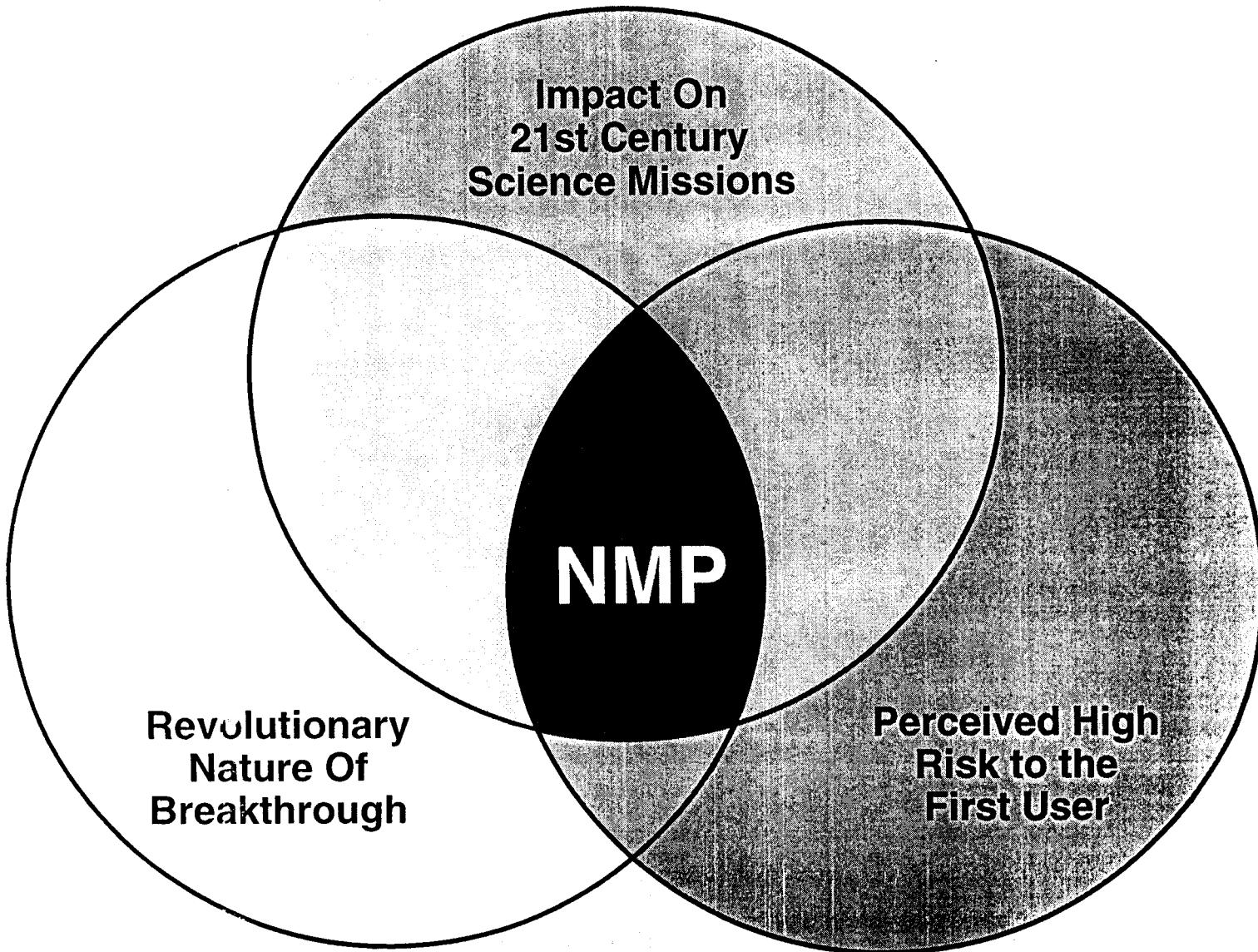


# NMP Program Objective

- Conduct space flight validation of breakthrough technologies which will significantly benefit future Space Science and Earth Science missions
  - Breakthrough technologies focused on:
    - \* Enabling new capabilities to fulfill the Science Enterprises' needs
    - \* Reducing costs of future missions
  - Flight validation to mitigate risks to first users and enable rapid infusion into future missions



# Program Focus





# NMP Flight Team Partners and IPDT Members

## San Francisco Area

- Arc
- Lockheed Martin
- Optivision
- Stanford U
- SCC

•Primex  
•Boeing

## Los Angeles Area

- Hughes
- ISX
- L'Garde
- Lockheed Martin IS
- Orbital Science
- TRW
- USC
- U of C

•Naval PGS

•SBRC

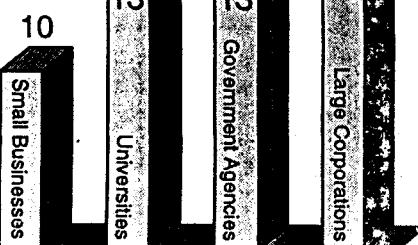
•UCSD

•Spectrum Astro

•U of AZ

- Ball Aerospace
- Lockheed Martin
- U of CO

- AFRL
- Los Alamos NL
- Sandia NL
- U of INM



## New England Area

- Lockheed Martin Sanders
- MIT
- Raytheon
- SSG
- U of MA

•U of WI

•CMU  
•LeRC

•WPAFB

•Yardney  
Honeybee Robotics

•LaRC

## D. C. Area

- APL
- DARPA
- GSFC
- Litton
- Lockheed Martin
- NOAA
- NSF
- NRL
- Swales
- TRW

•Georgia Tech

•U of A, Huntsville  
•Coherent Technologies  
•MSFC

•Honeywell

•SWRI



# IPDT's Represent Broad Spectrum of Government Agencies, Universities and Industry

	Member Organizations
Microelectronics	USAF Research Lab, Boeing, Georgia Tech, GSFC <sup>1</sup> , Hughes, Honeywell, Irvine Sensors, JPL <sup>2</sup> , APL <sup>3</sup> , LeRC <sup>4</sup> , Lockheed-Martin, MIT/LL <sup>5</sup> , Optivision, Sandia National Lab, Space Computer Corp., Space Electronics Inc., TRW, UC/San Diego, Univ. of New Mexico, USC
Telecommunications	Boeing, GSFC, JPL, APL, Lockheed-Martin, Raytheon
Multifunctional Structures and Modular Systems	GSFC, Honeybee Robotics, JPL, LaRC <sup>6</sup> , L'Garde, MIT, ARC <sup>7</sup> , NOAA <sup>8</sup> , Primex, SGG, Univ. of Arizona, Univ. of Colorado, USAF Research Labs, Yardney, NRL <sup>9</sup>
In-Situ Instrument and Micro Electro-mechanical Systems	DARPA, USAF Research Labs, Ball Aerospace, JPL, APL, LANL <sup>10</sup> , NSF, U.S. Navy Postgraduate School, Sandia National Lab, Southwest Research Institute, Stanford Univ., Univ. of So. Calif./ISI
Autonomy	ARC, Carnegie-Mellon Univ., GSFC, ISX Corp., APL, JPL, Lockheed-Martin, Stanford Univ., TRW, USAF Research Lab.
Instrument Technologies and Architecture	Ball Aerospace, GSFC, ITT Aerospace, JPL, APL, Lockheed-Martin, MSFC <sup>11</sup> , MIT/LL, LaRC, NRL, NOAA, Orbital Sciences Corp., Raytheon, SGG Corp., TRW, Univ. of Wisconsin

<sup>1</sup>NASA Goddard Space Flight Center

<sup>2</sup>Jet Propulsion Laboratory

<sup>3</sup>Johns Hopkins Applied Physics Lab

<sup>4</sup>NASA Lewis Research Center

<sup>5</sup>MIT/Lincoln Laboratory

<sup>6</sup>NASA Langley Research Center

<sup>7</sup>NASA Ames Research Center

<sup>8</sup>National Oceanic and Atmospheric Administration

<sup>9</sup>Naval Research Laboratory

<sup>10</sup>Los Alamos National Laboratory

<sup>11</sup>NASA Marshall Space Flight Center

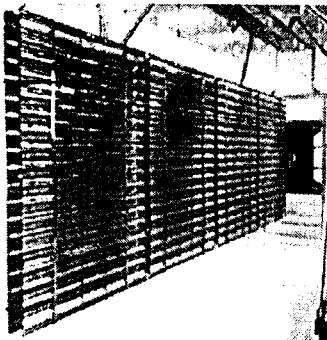


# NMP Mission Launch Schedule

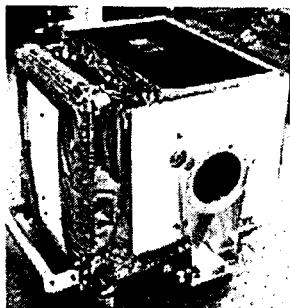


	Mission	FY98	FY99	FY00	FY01	FY02	FY03
Approved Missions	DS-1 (Asteroid/Comet Flyby)		10/98 ▲				
	DS-2 (Mars Impact Lander)		01/99 ▲				
	EO-1 (Formation Flying/ Hyperspectral Imager)			12/99 △			
	EO-2 (Coherent Lidar Expt)				03/01 △		
Proposed Missions	DS-3 (Multi S/C Interferometer)					09/03 (target) △	
	DS-4 (Comet Lander)					04/03 (target) △	
	ST-5 target launch window						
	EO-3 target launch window						

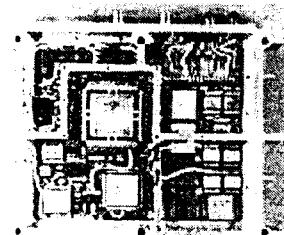
# Representative Technologies Validated on DS-1 (Cont'd)



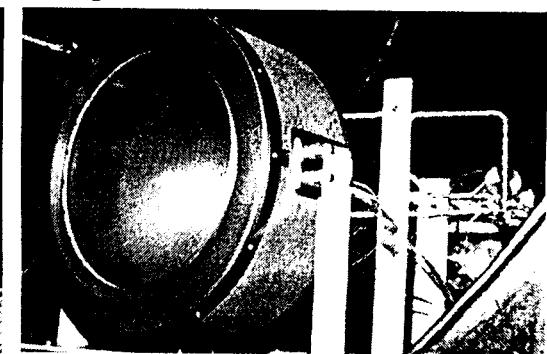
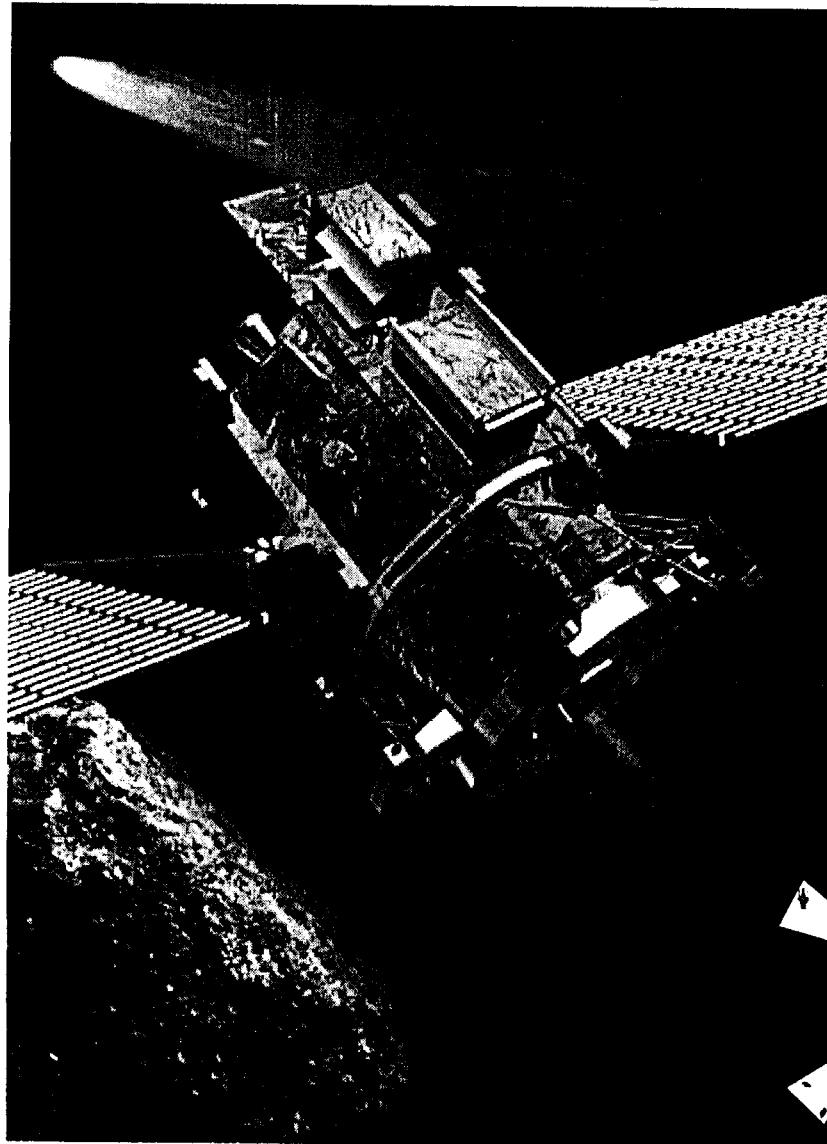
Advanced Solar Concentrator Array



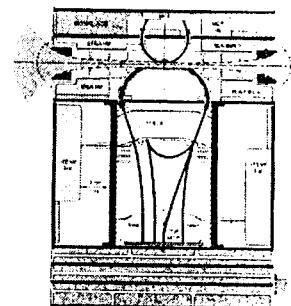
Miniature Integrated Camera Spectrometer



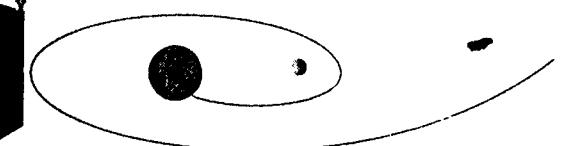
Small Deep Space Transponder



NSTAR Ion Propulsion System



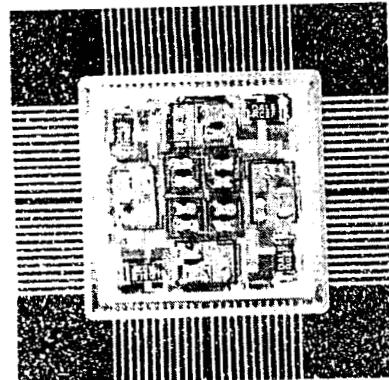
Plasma Experiment for Planetary Exploration



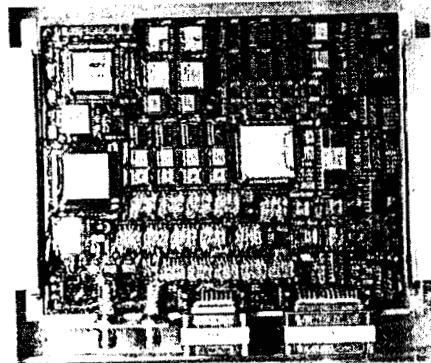
Autonomous Onboard Optical Navigation



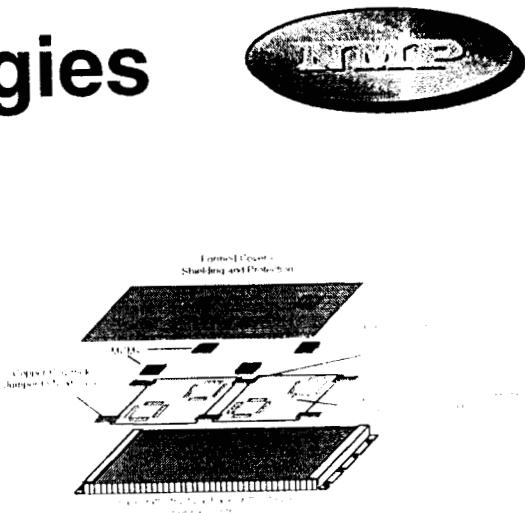
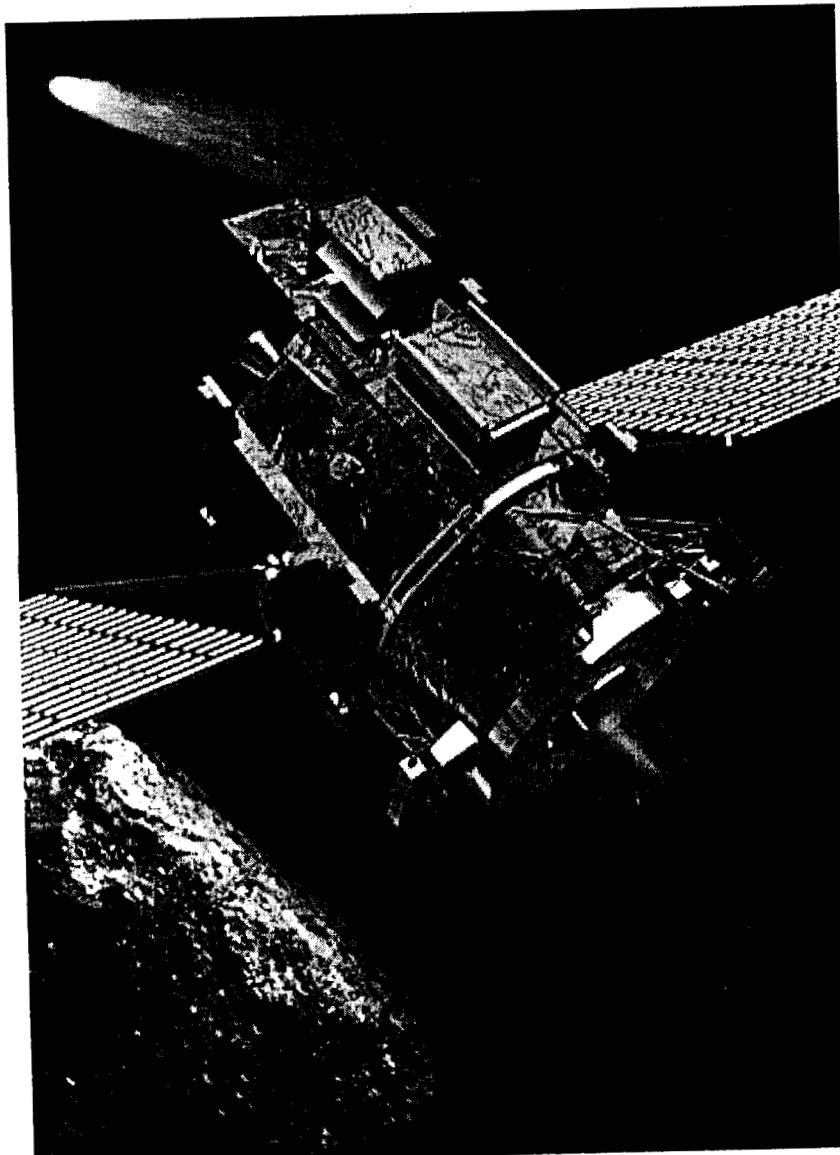
# Representative Technologies Validated on DS-1



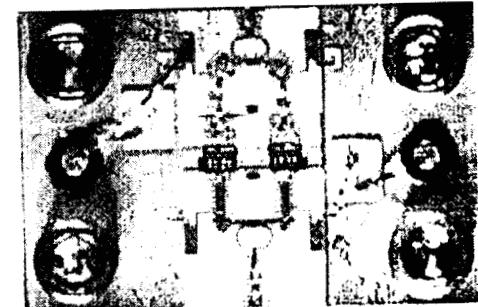
Power Activation and  
Switching Module



Low-Power Electronics  
Experiment



Multifunctional  
Structures



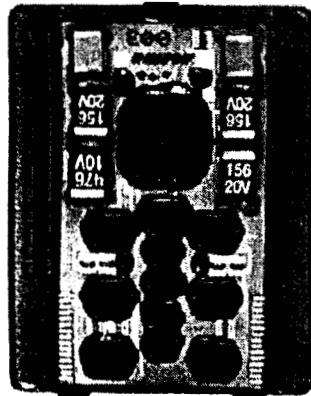
Ka-Band Solid State  
Power Amplifier



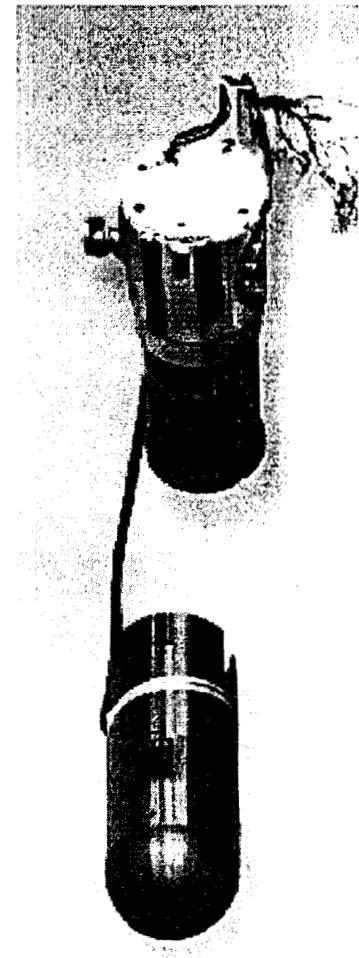
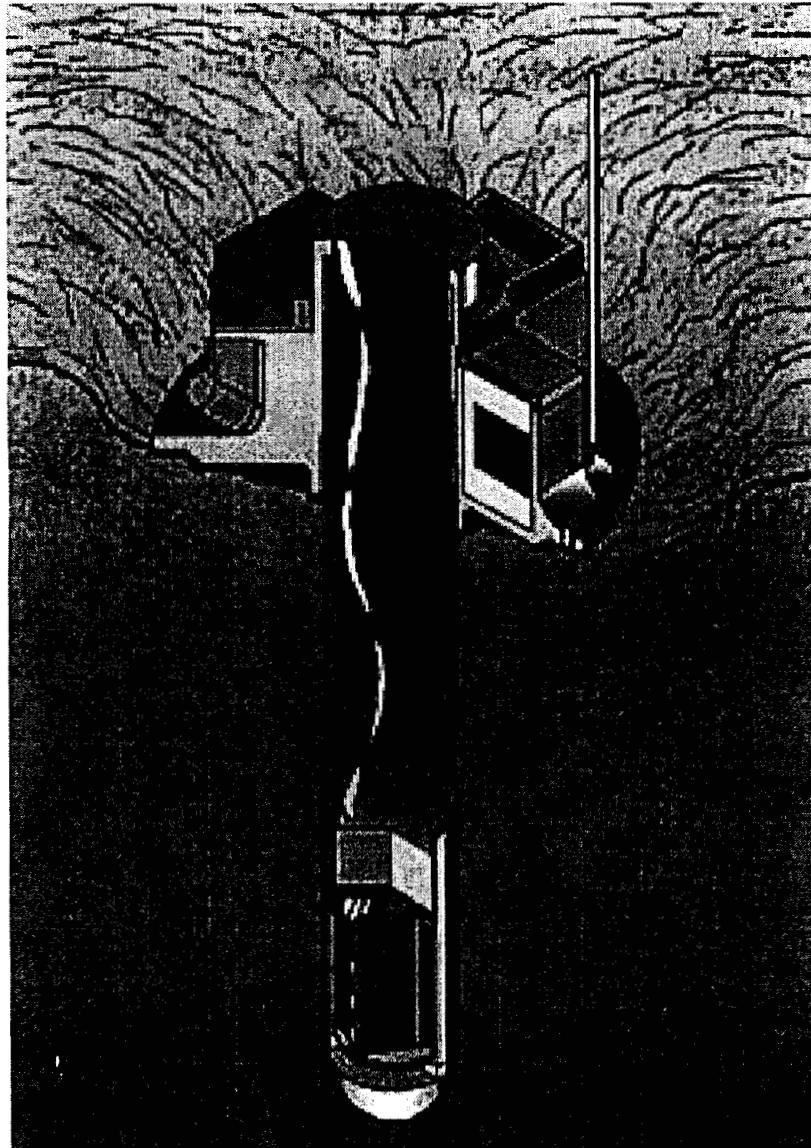
# Technologies to be Validated on DS-2



Advanced  
Microcontroller



Power  
Microelectronics Unit



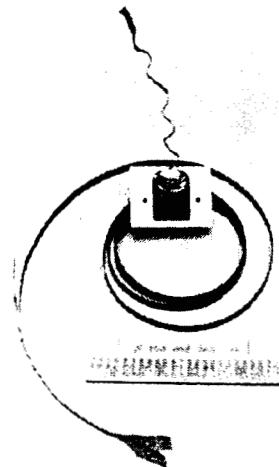
Evolved Water  
Experiment / Soil  
Thermal Conductivity  
Experiment



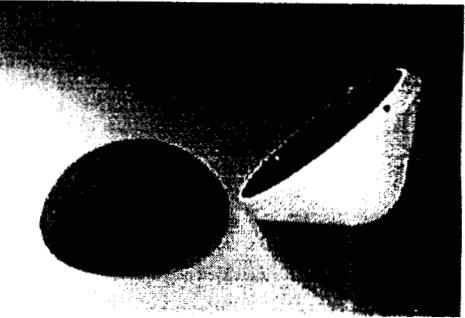
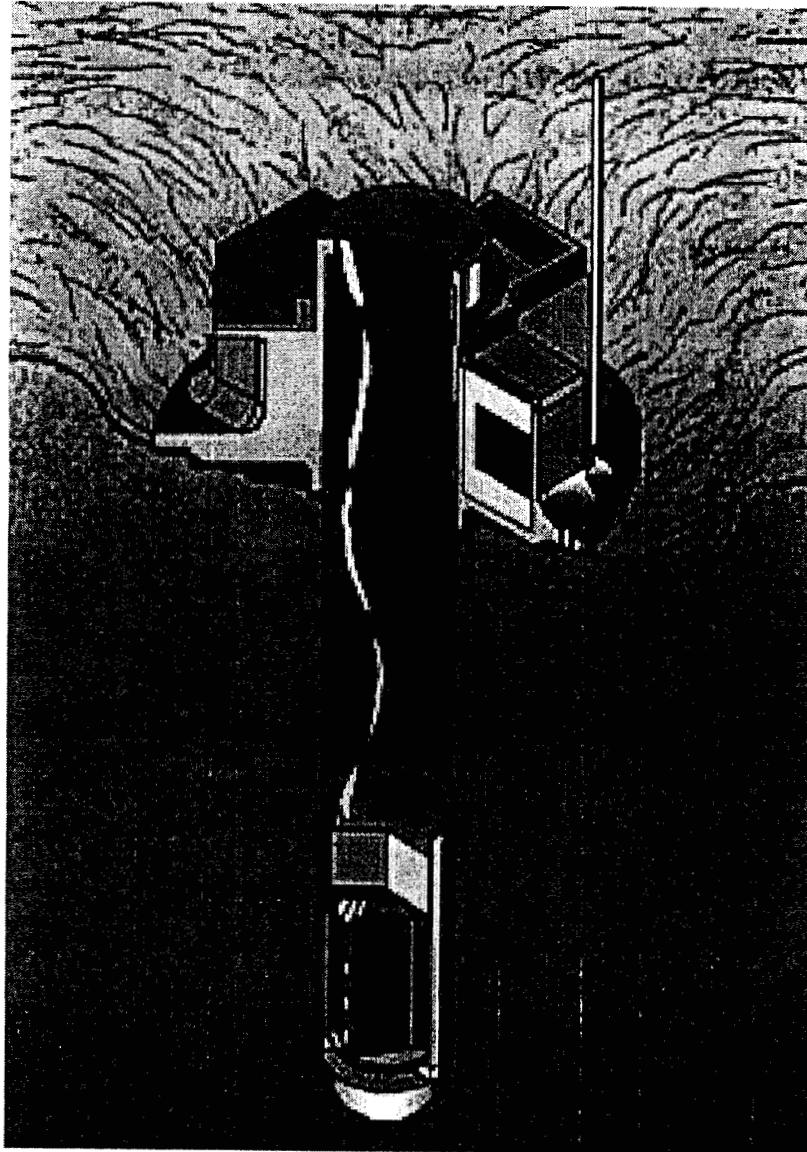
# Technologies to be Validated on DS-2 (Cont'd)



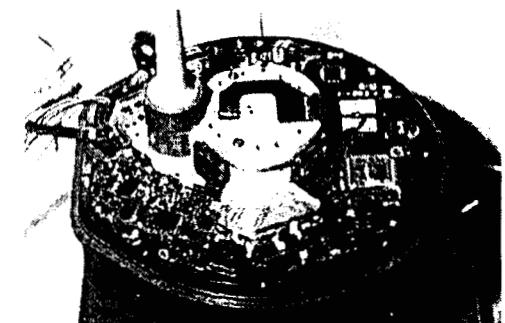
Lithium-Thionyl Chloride  
Primary Battery



Flexible Cable  
Interconnect



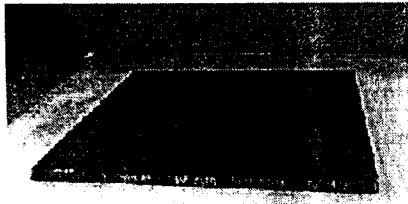
Aeroshell/Entry System



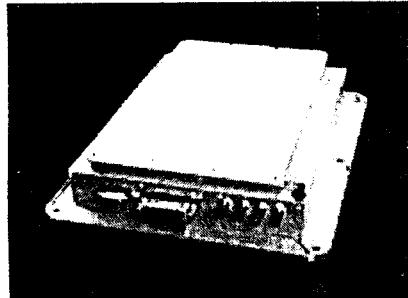
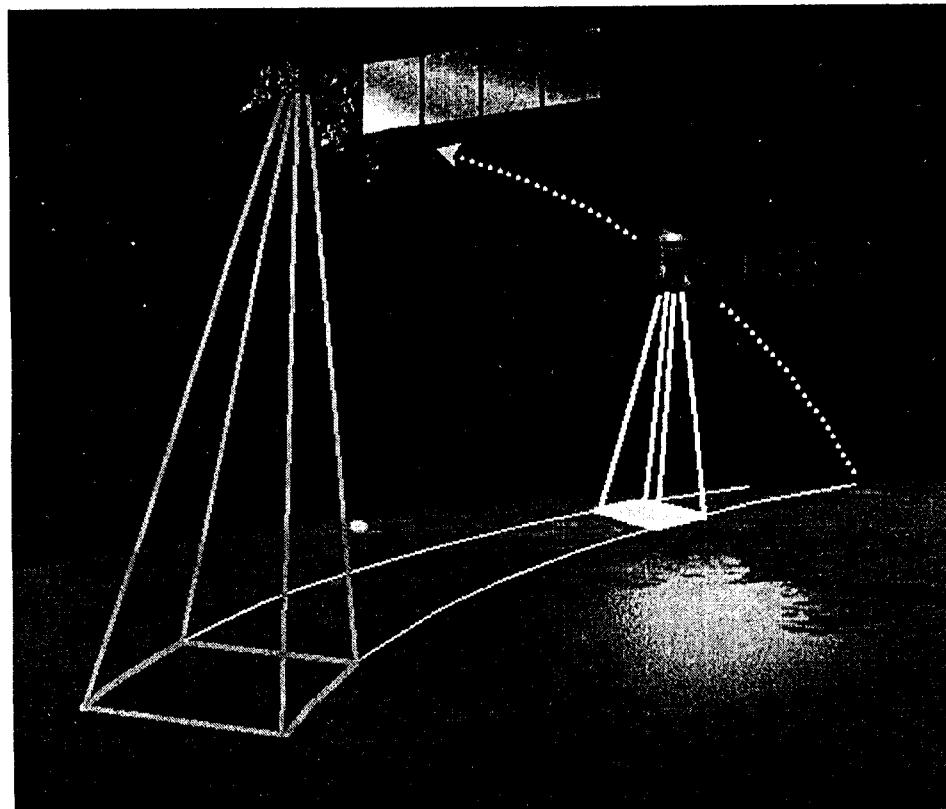
Compact Telecom System



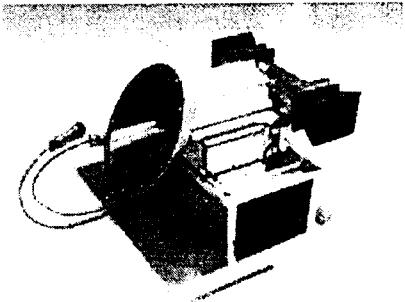
# Technologies to be Validated on EO-1



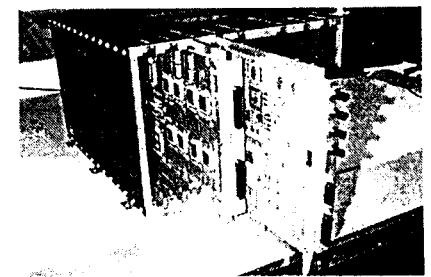
Carbon-Carbon  
Radiator



X-Band Phased Array  
Antenna



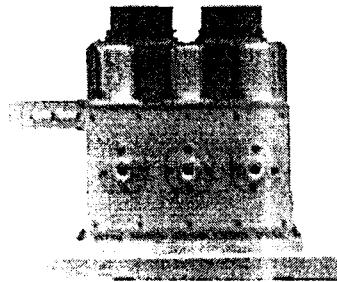
Pulsed Plasma  
Thruster



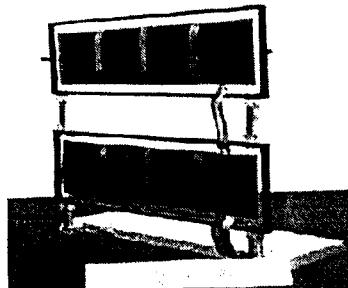
Wideband Advanced  
Recorder Processor



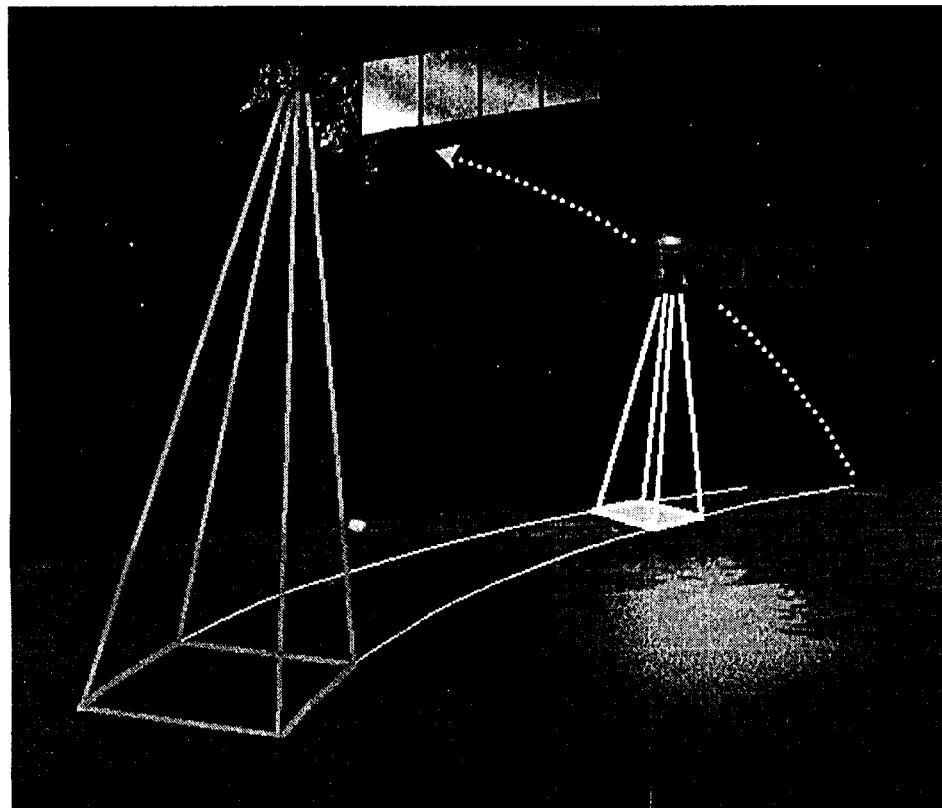
# Technologies to be Validated on EO-1 (Cont'd)



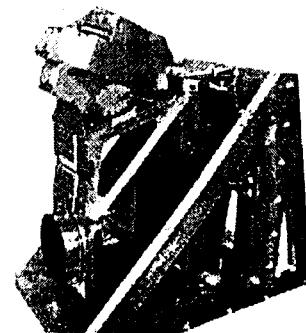
Atmospheric  
Corrector



Lightweight Flexible  
Solar Array



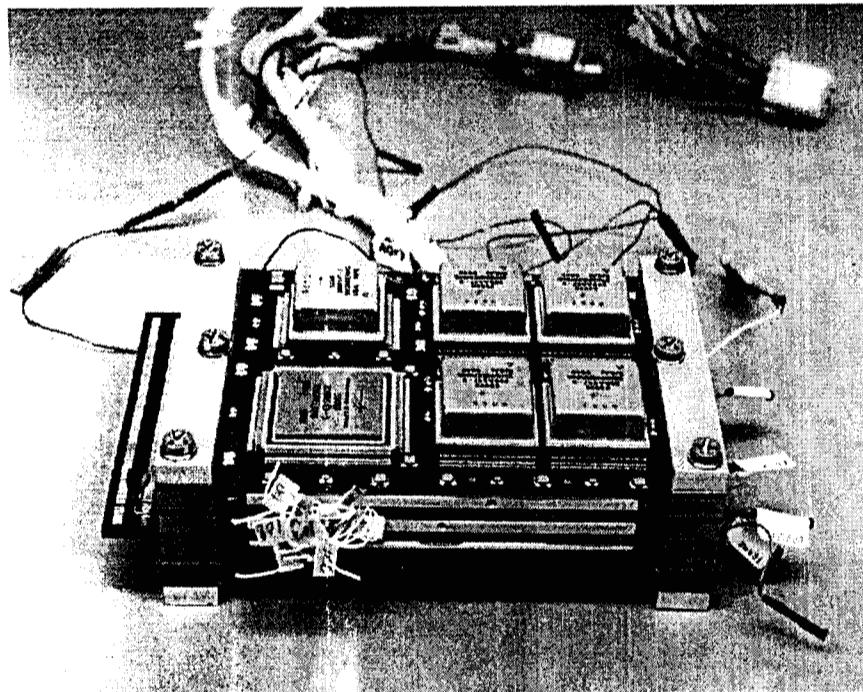
Advanced Land  
Imager



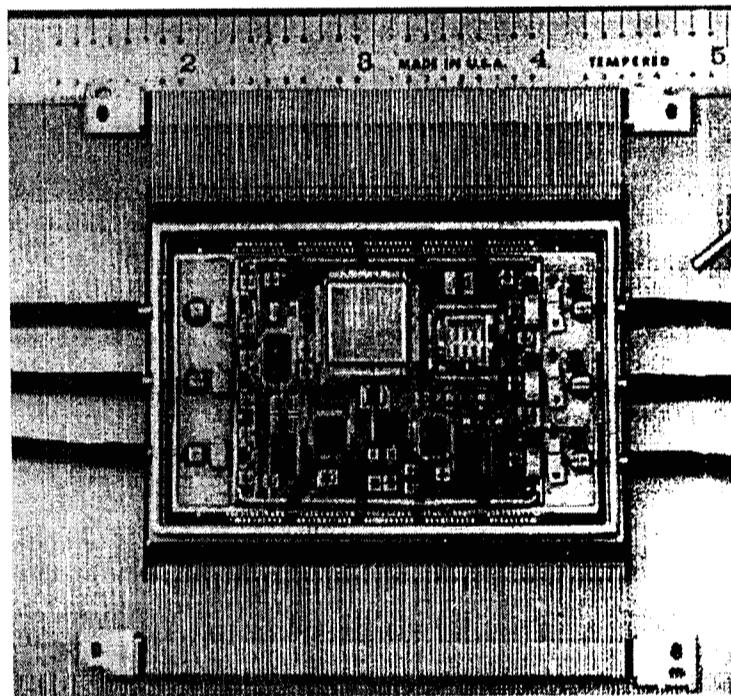
Hyperion Instrument



# Other NMP Microelectronics Technologies



3D Flight Computer



Fiber-Optic Data Bus



# Summary

- DS-1 launched 24 October 1998
  - Low Power Electronics Experiment operational/data analysis underway
  - Power Activation and Switching Module operational/data analysis underway
  - Multi-Functional Structures operational/performance parameters verified
  - All other technologies operational/performance analysis in progress
- DS-2 launched 3 January 1999
  - Expected to impact near Mars southern polar region on 3 December 1999
- EO-1 on schedule for launch in December 1999

More details on microelectronics technologies  
in this Session and in Session 8A